THE ECONOMIC JOURNAL

The Economic Journal, **128** (*March*), 541–575. Doi: 10.1111/ecoj.12432 © 2016 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

PARTY CONNECTIONS, INTEREST GROUPS AND THE SLOW DIFFUSION OF INFRASTRUCTURE: EVIDENCE FROM BRITAIN'S FIRST TRANSPORT REVOLUTION*

Dan Bogart

Economic and political interests often block or delay infrastructure improvements. This article examines their effects by studying Britain's river navigation improvements in the early 1700s – a subject of intense lobbying in parliament. It shows that stronger party connections and influence in neighbouring areas likely to oppose or support projects affected whether a town got a river navigation act. Their estimated effects are comparable to geography and town economic characteristics in magnitude and help explain whether towns were blocked from getting navigation improvements. The findings address institutions following the Glorious Revolution and broader issues concerning infrastructure, technology diffusion and political connections.

> Good Roads, canals and navigable rivers, by diminishing the expense of carriage, put the remote parts of the country more nearly upon a level with those in the neighbourhood of the town. They are upon that account the greatest of all improvements . . . It is not more than fifty years ago that some of the counties in the neighbourhood of London, petitioned the parliament against the extension of the turnpike roads into the remoter counties. Those remoter counties, they pretended, from the cheapness of labour, would be able to sell their grass and corn cheaper in the London market than themselves, and would thereby reduce their rents, and ruin their cultivation.
>
> Adam Smith, *the Wealth of Nations*, Chapter XI, Of the Rent of Land ([1776] 1976, p. 164).

In the face of opposition, infrastructure improvements are often slow to diffuse. One commonly held view is that infrastructure projects are more likely to be blocked if opposing interest groups have more influence and connections with politicians and the government.[1] The case of Britain in the early 1700s is instructive because powerful interest groups often lobbied to reject infrastructure bills when they came up in parliament. In the passage above, Adam Smith notes that landowners close to London

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I thank Robert Oandasan, Larry Bush, Thomas Wheeler, Amanda Compton and Alina Shiotsu for providing valuable research assistance. I also thank Leigh Shaw Taylor for sharing population data and Stergios Skaperdas, John Wallis, Steve Nafziger, David Chambers, Latika Chaudhary, Gary Cox, Alex Klein, Kara Dimitruk and Gary Richardson for helpful comments on earlier drafts. Also I thank participants at the Caltech Early modern group 2012, the 2012 ISNIE meetings, the Western Economic Association meetings and seminar participants at UC Irvine, Lund University, Oxford University, University of Edinburgh, Cambridge University, University of Arizona, UCLA, USC, University of Maryland, Yale, Ohio State, the Institute for Historical Research in London and the World Economic History Congress 2015 for their comments. Lastly I thank the UC Irvine Council on Research, Computing and Libraries for grant support. All errors are my own.

[1] As one example, see the article in the Economist on why extensions to runways at Heathrow airport are taking so long. http://www.economist.com/blogs/economist-explains/2015/07/economist-explains-1.

petitioned against the extension of turnpike roads during the early 1700s because it threatened their rents. Bills for river navigation improvements were especially prone to opposition from neighbouring landowners. In one case, the gentlemen and freeholders of Somerset contended the river Avon navigation project would be a 'great prejudice to all parts of the county by bringing corn and other commodities from Wales, where the value of lands are low'. Opposition also came from neighbouring property owners and some towns. Henry Parsons lobbied against the Avon bill arguing that his six mills 'would be rendered useless to the great loss of the poor and to himself'. Officials in Bristol, the navigation head of the Avon, argued that 'the bill contained clauses that may be construed to interrupt their ancient rights'.[2]

The role of interest groups and connections also speaks to broader debates about Britain's institutions in the decades after the Glorious Revolution of 1688–9. Some works in the literature see Britain's institutions as being conducive to economic growth, either because they protected property rights and eased the financing of wars, or because they allowed for an active parliament (North and Weingast, 1989; Acemoglu *et al.*, 2005; Bogart and Richardson, 2011; Bosker *et al.*, 2012; Cox, 2012). But many scholars have noted that corruption was common in the early eighteenth century making it less obvious that Britain's institutions supported investment and innovation (O'Brien *et al.*, 1991; Harris, 2000; Mokyr and Nye, 2007; Zahedieh, 2010; Pettigrew, 2013; Temin and Voth, 2013). Moreover, some have argued that the Whig and Tory parties maintained majorities in the House of Commons by appeasing local interests, including those opposed to policies that might have aided economic development (Plumb, 1967; Speck, 1970; Colley, 1985; Holmes, 1987; O'Gorman, 1989; Black, 1990; Carruthers, 1999; Stasavage, 2003, 2007; Pincus, 2009; Pincus and Robinson, 2011; Dudley, 2013).

This article quantifies the effect of interest groups, political parties and party connections at a micro-level and gauges their significance. The empirical analysis studies the diffusion of acts authorising river navigation improvements across towns in England and Wales. I first estimate a discrete time hazard model specifying the probability a candidate town adopted a river act in each of the 14 parliaments from 1690 to 1741. Candidate towns have rivers, but they were not navigable by 1690, or they did not have river acts in earlier parliaments. The second model examines the probability a town's river bill succeeded in parliament given it was introduced. The aim in both models is to test whether the influence and party connections of interest groups have large effects in comparison to the geographic and economic characteristics of candidate towns.

The data set contains new spatial measures on infrastructure and the economic characteristics of all market towns in England and Wales. I also add new spatial data on Members of Parliament (MPs) and their party affiliation. The variables include population and economic specialisation indicators for candidate towns, the same for their neighbouring towns, and measures of whether the candidate town's neighbouring MPs were connected to the majority party, either the Whigs or Tories. Crucially, since location is important for infrastructure projects, I separate the neighbouring majority party MPs and neighbouring towns into upstream and downstream areas

[2] The preceding petitions can be found in the *Journals of the House of Commons*, vol. 17, p. 112 (26 February 1712), p. 132 (12 March 1712) and p. 134 (13 March 1712).

based on the location between a candidate town and its navigation head. The data show that opposition to river bills often came from downstream areas, while support often came from upstream. Building on these patterns I use upstream and downstream majority party MPs to measure the party connections of likely supporters and opponents of navigation.

There are several notable findings. First, more favourable geography and economic characteristics, like manufacturing specialisation and high market potential, were among the most important factors determining whether towns adopted river acts. Second, the identity of the majority party in the House of Commons mattered. The adoption of river acts was more likely in parliaments with Whig majorities compared to Tory majorities. Third, the characteristics of neighbouring towns and neighbouring majority party MPs had the largest impact in determining whether river bills succeeded in parliament. For example, having more towns on the road network upstream, more towns with water navigation downstream and more majority party MPs representing the county all made a town's river bill significantly more likely to succeed. Having more majority party MPs downstream and more harbour towns downstream had the opposite effect. These findings have a broader implication because they suggest that greater influence and connections among opposing and supporting interests played a significant role in parliament's decision to approve or reject river bills.

I also show that differences in influence and connections can explain why some towns were 'blocked' from getting a river act. A blocked town is one that had a bill in parliament but did not get an act by 1741 (the end of my analysis). The coefficient estimates combined with the observed differences between blocked and 'successful' towns show that variables for neighbouring town characteristics had large effects. The effect of majority party MPs downstream was not as large but it still played a significant role in blocking.

Several extensions to the baseline model are analysed. One examines whether omitted variable bias affects the estimates of majority party MPs. I address this issue using panel models with town and parliament fixed effects. I also use distinctions between incumbent and newly elected MPs to get plausibly exogenous sources of variation in party connections. The results confirm that having more majority party MPs downstream slowed adoption but the positive effect of more majority party MPs in the town's county is less robust. Another extension explores heterogeneity and finds the effects of majority party connections vary depending on whether the Whigs or Tories were in the majority and the degree of electoral competition in neighbouring constituencies.

The results contribute to several literatures. For economic history, the most important finding is that Britain's institutional environment c. 1700 was not favourable to the rapid adoption of infrastructure because of interest group pressures and party politics. This contribution is explained further in the following section. Other related literature points to the distributional effects of infrastructure projects, specifically dams in India (Duflo and Pande, 2007) and highways in China (Faber, forthcoming). This article shows how potentially disaffected groups (specifically, in this context, downstream interests) can manipulate the political process to prevent the realisation of negative effects.

Another related literature studies the effects of political connections on firm-level outcomes, or on regions through party or ethnic representation. These studies generally find that political connections provide value to firms (Faccio, 2006; Faccio

et al., 2006; Jayachandran, 2006; Ferguson and Voth, 2008; Blanes i Vidal *et al.*, 2012; Cingano and Pinotti, 2013). Many also show that government-spending patterns differ when a district or region is strongly represented by the majority party or ethnic group in power (Levitt and Snyder, 1995; Lee, 2003; Curto-Grau *et al.*, 2012; Albouy, 2013; Burgess *et al.*, 2015). This article adds to this literature by demonstrating the effects of party connections in a setting with frequent turnover in the majority party. In most modern contexts the majority party changes infrequently, making identification of party connections challenging. Also, by using differences between incumbent and newly elected MPs, this paper employs a new method for addressing omitted variable bias in studies of majority party connections.

A final, related literature concerns vested interests and the diffusion of technologies.[3] By studying an important case in careful detail, this article contributes to a general understanding of efforts to block technologies and their connection with institutions.

The remainder of the article is organised as follows. Sections 1 and 2 provide background on politics, development and river acts. Section 3 describes the empirical strategies. Sections 4 and 5 introduce the data. Sections 6 and 7 present the estimation results of the baseline models. Sections 8 and 9 examine extensions. Section 10 concludes.

1. Background on Politics and Development in Britain

Over the eighteenth century, Britain emerged as the leading economy of Europe. Scholars have long debated the explanations for Britain's divergence. With respect to institutions, much of the debate focuses on the greater role of parliament after 1688–9, and whether it helped to foster development. One important aspect concerns acts of parliament creating corporations. The largest corporations were the Bank of England, the East India Company and the South Sea Company. Aside from the three 'monied' companies, there were many other smaller trusts and joint stock companies that resembled public utilities in the twentieth century. They focused on infrastructure projects such as building roads, canals, bridges, courts and marketplaces. The broad diffusion of utilities was one of the driving forces in Britain's economic growth. They helped to catalyse the development of Britain's transportation and trading infrastructure.[4]

Acts for utilities and corporations were more common in the decades following the Glorious Revolution than in the decades before (Bogart, 2011). But, like many new technologies, it proved quite difficult to form corporations in Britain. Bills proposing corporations had notoriously high failure rates in parliament, sometimes resulting in long delays or blocking of entry and projects. Opposition from interest groups was the most direct reason corporate bills failed. According to some scholars, the influence of interest groups was so fundamental that political factors played a comparatively minor role. Harris (2000, p. 135) summarises this perspective:

> 'barriers on entry into the corporate world was not created by Parliament intentionally, nor was it to any considerable degree manipulated by Parliament

[3] For contemporary studies see Comin and Hobijn (2009) and Bellettini *et al.* (2014). For historical studies see Mokyr (1990), Rosenthal (1992), Mokyr and Nye (2007) and North *et al.* (2009).

[4] For an overview and related literature on transport's contribution to growth see the summary by Bogart (2014).

> . . . Parliament served only as the arena and set the procedural rules. The arena was left open to the active players in this game, the vested interests. And it was the vested interests which created the barriers on entry'.

Arguments placing more emphasis on politics tend to focus on the Whigs and Tories, the main two political parties from the late 1670s through the 1760s. They had an intense competition in the eleven parliaments between 1690 and 1721, with the majority party in the elected House of Commons switching seven times. The Whigs and Tories differed in their policy positions with the Tories favouring privileges for the Church of England, lower taxes and a small government debt. The Whigs generally favoured religious toleration and an aggressive foreign policy. The two parties also differed in their supporters. The Tories were favoured by small to medium landowners, and the Whigs by merchants, financiers and large landowners.

The Whig party came to dominate the Commons after 1721. They held a majority in the four parliaments from 1722 to 1741 and for some decades after. One reason was the demise of the Tories as an effective opposition party after they were associated with a failed rebellion against the monarchy in 1715. Another was the emergence of Robert Walpole as the leader of the Whigs. Serving as the first Prime Minister from 1721 to 1742, Walpole was especially effective in using government favours to secure a working majority in the Commons.

There is a large historical literature on Britain's political parties (Walcott, 1956; Namier, 1957; Plumb, 1967; Speck, 1970; Hill, 1976; Horwitz, 1977; Black, 1990; Harris, 1993). One of the main debates concerns their capabilities in coordinating the actions of their fellow MPs. Holmes (1987, p. 287) argues that the party organisation was achieved by 1701 despite the fact that the Whigs and Tories did not possess a modern party machine and a system of official whips. There are mixed views about the role of parties in organising local policies. Holmes (1987, p. 45) argues that MPs would vote across party lines when it came to bills for duties and taxes affecting their constituency. But other historians have detected examples where party politics clearly influenced local affairs. According to Colley (1985), as soon as the Whigs secured control of Norwich Corporation in 1715 they made sure its plumbing and street lighting contracts went only to Whigs. This paper is the first to test empirically whether Britain's early parties had the capability of targeting local policies to their supporters, much like modern parties (Cox and McCubbins, 1986; Lindbeck and Weibull, 1987; Dixit and Londregan, 1996 for targeting).

Another strand of the literature emphasises differences between the Whigs and Tories in terms of strategies and connections. Stasavage (2003, 2007) provides evidence that British government bond yields were lower when the Whigs had a larger majority. Stasavage argues that bondholders were a key part of the Whig coalition. Likewise, Dudley (2013) argues that the Whigs were more favourable to the manufacturing sector and worked to assist this sector when they had a majority. Pincus (2009) and Pincus and Robinson (2011) see the Whigs as being more favourable to development projects including infrastructure. The differences between the two parties will be explored below. Like previous works, I use switches in the majority party to identify party effects. Unlike previous work, my analysis uses town-level data and investigates differences in the way party connections worked.

1.1. *Background on River Navigation Acts*

Preceding canals and railways, river navigation was a key part of Britain's early transport system. A river navigation act established a company or authority with rights to levy tolls and purchase land necessary for improvements in navigation. The tolls were subject to a price cap and there were provisions on how the project was to be carried out, including how landowners would be compensated for damages. Notably, there were no public subsidies, so all financing came from investors in the companies (Willan, 1964).

Through their statutory powers, navigation companies played a key role in the extension of inland waterways. Nearly all the companies that got acts successfully built locks and dredged rivers. In the process, they increased the length of navigable waterways in England and Wales. Figure 1 draws on Willan (1964) to illustrate the changes. The black lines show rivers that were navigable in 1690 and the grey lines depict rivers with acts improving their navigation by 1741. Generally, acts extended navigation near the coast or on existing navigable rivers. They gave established and emerging towns better access to waterway transport.

The extension of river navigation to a town generally increased its economic prospects. Improved navigation lowered transport costs since freight rates by inland waterway were approximately one-third the freight rates by road. Many contemporaries, including Daniel Defoe (1724), argued that trade increased for a city when it was connected to the waterway network. In light of the economic importance of waterway transport it is significant that the diffusion of river navigation acts was fairly slow. It took nearly 50 years from 1690 to 1740 to extend navigation on the rivers in Figure 1. One immediate reason is that projects were proposed several times in parliament as bills before being approved and some bills were never approved at all.

The House of Commons was the key decision-making body for river bills. Projects started as an order for a bill or as a petition by the public, with petitions becoming the dominant form after 1700. Petitions were assigned to a special committee of MPs who would draft a bill to be reviewed by the entire Commons. The committees had around 25 MPs but there was a norm that any MP from the neighbouring counties and boroughs could attend. Another norm was that any interested individual or group could petition the committee in favour or against the bill. The next Section documents how petitioning campaigns were a prominent feature of river navigation bills.

2. River Bills, Acts, and Towns: Background and Data

The *Journals of the House of Commons* provide rich information on all river navigation bills. The details of every river bill from 1690 to 1741 were entered in a spreadsheet, including petitions, orders of the House, committee reports, votes, amendments and whether the bill became an act.[5] Several key features of river bills are summarised in Table 1. First, less than half of all river bills succeeded, confirming that success was far

[5] See Hoppit (1997) and Bogart (2011) for more details on the *Journals* as a source. Note that votes are only occasionally reported and include only the names of the 'tellers' for yes and no and the totals for each side. Also note there were two types of river bills, one to make rivers navigable and the other to amend the rights of a river navigation authority created by a previous act. The analysis here focuses on bills to make rivers navigable.

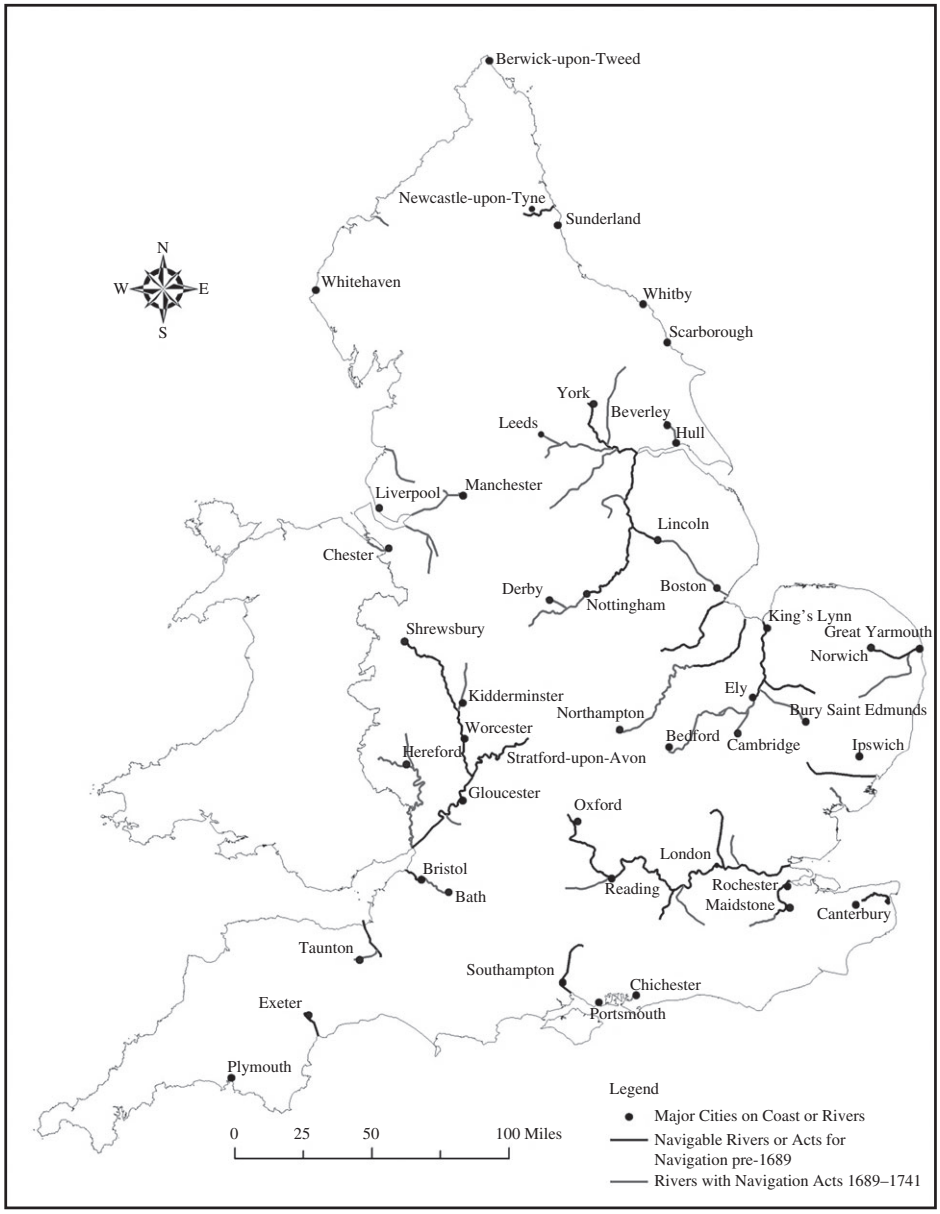

Fig. 1. *Navigable Rivers and River Navigation Acts in England and Wales, 1690–1741*
Source. See text.

from guaranteed. Second, over 80% of river bills started with a petition from groups outside the Commons. The rest started as an order for a bill from within the Commons but the origin is never stated. Third, officials or inhabitants of a town were the most common group to start a bill through a petition. Less than 20% of the original petitions came from landowners or individuals with unstated locations. Fourth, most bills had supporting petitions from towns (82.6%) but just over one-third (37.6%) had

Table 1

Summary of River Bills, Acts and Petitions Drawn from Journals of House of Commons

Panel (a): Number of bills and acts	
Number of River bills in all parliaments between 1690 and 1741	69
Number of River acts in all parliaments between 1690 and 1741	32
Percentage of river bills succeeding between 1690 and 1741	46.3
Average Number of bills per parliament between 1690 and 1741	4.93
Average Number of acts per parliament between 1690 and 1741	2.29
Panel (b): Origins of bills	
Number of river bills starting with petition from group outside Commons (%)	56 (81.2)
If bill starts with petition, number where officials or inhabitants from a town are named in original petition (%)	45 (80.3)
Panel (c): Supporting and opposing petitions for bills	
Number of bills with at least one town supporting (%)	57 (82.6)
If at least one town supports, average number of supporting towns per bill	2.81
Number of bills with at least one town opposing (%)	26 (37.6)
If at least one town opposes, average number of opposing towns per bill	3.38
Number of bills where landowners adjacent to river opposed (%)	22 (31.8)
Number of bills where county officials opposed (%)	10 (14.5)
Number of bills where county officials supported (%)	18 (26.1)

Source. See text.

opposing petitions from towns. When at least one town opposed, there were often several more (3.38 on average). Fifth, just under one-third of bills had opposing petitions from landowners who self-identified as being near or adjacent to the river. They rarely supported bills. Sixth, county officials, like justices of the peace, both opposed and supported bills, although support was more common.

The frequency of petitions suggests that a variety of interests influenced river bills. Towns were clearly important because they originated over 80% of bills through petitions. Towns also opposed more than a third of bills. In the analysis below, I focus on the diffusion of river bills and acts across towns and study how the characteristics of a town and its neighbouring towns influenced adoption. The town database is drawn from Richard Blome's *Britannia* (1673). Blome's lengthy book is a guide to 782 market towns in England Wales. The list includes large cities like London, Bristol and Norwich. It also includes small and medium-sized towns that would later become industrial and shipping centres, like Manchester and Liverpool. Blome also describes the economic and political characteristics of towns, like whether it has manufacturing and municipal government. Finally, Blome provides county-level maps showing town locations, waterways, and coastal features.

All the towns in the Blome list are coded with a latitude and longitude. I then identify which towns were on navigable rivers or the coast, which were located on rivers or streams that could be made navigable, and which had neither. The classification is based on modern maps and Blome's county maps. Table 2 shows counts of towns in the three categories. There are 435 'candidate' towns that did not have access to river navigation by 1690 but did have water sources. For each candidate town, the route of its river or stream is traced to the coast or the navigation head using Google maps.[6] The total route distance in miles is recorded along with the starting elevation at the town and then again at the coast or navigation head.

[6] A particularly useful program is http://bikehike.co.uk/index.php which provides a 'course creator' tool.

Table 2

Summary of Towns and River Acts and Bills Matched to Towns

Panel (a): Blome market towns	
Number of towns in England and Wales c. 1670	782
Number of Towns on navigable rivers or coast c. 1670	110
Number of towns not on navigable rivers or coast c. 1670 and no water	237
Number of towns not on navigable rivers or coast c. 1670 but have water (candidate towns)	435
Panel (b): Candidate towns matched with river bills and acts	
Number of candidate towns matched with river bill between 1690 and 1741 (%)	74 (17.0)
Number of candidate towns matched with river act between 1690 and 1741 (%)	51 (11.7)
Number of candidate town-parliament matches with river bill	107
Panel (c): Towns with delayed and failed river bills	
Percentage of candidate towns with river bill that failed on first try	63.5
If first bill failed, percentage of candidate towns that got river act before 1741	51.0
If first bill failed and got act by 1741, average years between first bill and act	11.1
If first bill failed, percentage of candidate towns that got river act before 1830	91.5
If first bill failed and got act by 1830, average years between first bill and act	30.6
Average years between first bill and act (if act by 1830)	18.8

Source. See text.

The next step is to match river bills and acts with candidate towns based on descriptions of the project in the *Journals of the Commons*.[7] Panel (*b*) in Table 2 summarises towns matched to river bills and acts. In total 17% of the candidate towns had river bills across all parliaments between 1690 and 1741 but only 11.7% of towns had a river act. The implication is that river acts were limited to a relatively small number of towns by 1741. Also note that some towns had river bills across multiple parliaments due to failures. There are 107 town-bill-parliament matches compared to 74 towns matched to a bill in at least one parliament.

Further details on the failure of river bills among candidate towns are given in panel (*c*) of Table 2. Among the candidate towns with a river bill, nearly two-thirds had their first bill fail. Among these, just over half eventually got a river act by 1741. The time delay between first failure and first act averaged 11.1 years. The 23 candidate towns with river bills that did not get an act by 1741 were not necessarily blocked forever from inland water navigation. Among the towns whose first river bill failed, 91.5% eventually got a canal or river navigation act by 1830. Their eventual adoption took time however. Figure 2 shows the diffusion curve for all towns with at least one river bill before 1741. Many did not get river acts until long after 1741, when this study ends. Overall, the average time between first bill (anytime between 1690 and 1741) and the first navigation act (anytime between 1690 and 1830) was 18.8 years.[8]

More insights can be gained by examining towns ever petitioning in support or against river bills. I identified 94 towns in the Blome list with at least one supporting petition and 62 towns with at least one opposing petition. Supporting and opposing towns were similar in that both are close to the candidate town. To illustrate, distances are calculated between the candidate town for each river bill and all towns supporting or opposing its

[7] The average number of matched towns per bill was 1.55, and the median number of towns per bill was 1. Two river bills, dealing with the Wivenhoe and Beverley Beck, could not be matched to any towns in Blome.

[8] It is also revealing that the average time between first failed bill (anytime between 1690 and 1741) and the first navigation act (anytime between 1690 and 1830) is 30.6 years. See the last entry of Table 2.

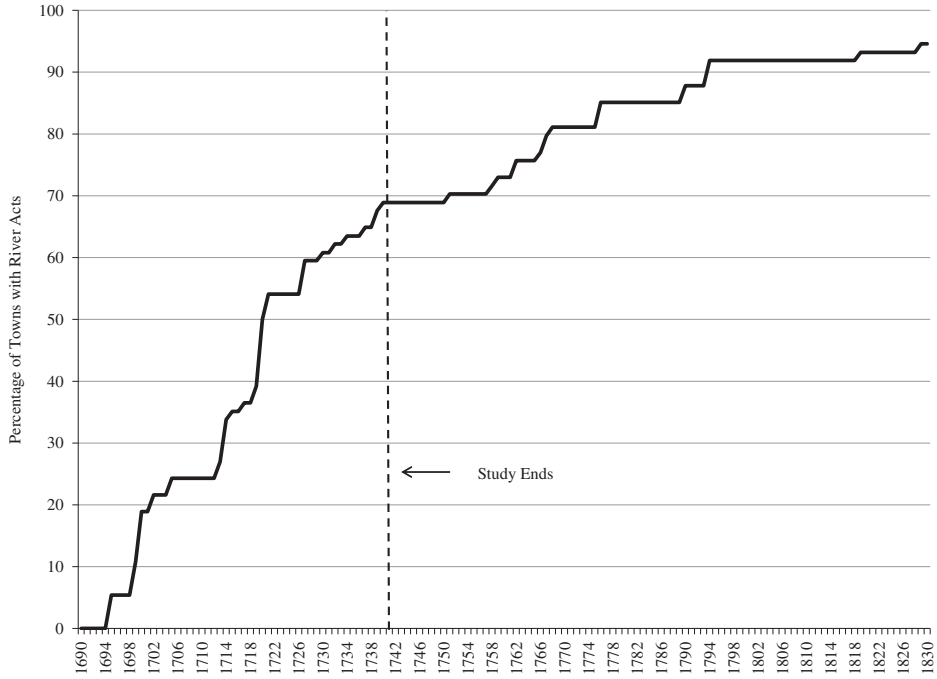

Fig. 2. *Diffusion Curve for Towns with at Least One River Bill between 1690 and 1741*
Source. See text.

bill in a parliament.[9] In cases where bills had multiple candidate towns, the candidate town that is most 'downstream' is used. The example of the river Nene bill is shown in Figure 3. Northampton is the most upstream candidate town relative to the navigation head in Peterborough. Wellingborough, Higham Ferrers, and Thrapston are candidate towns further downstream. Panel (*a*) of Table 3 reports that the average supporting town was 22.8 miles from the most downstream candidate town and the average opposing town was 20 miles. Although similar in their means, supporting towns tended to be more widely distributed. Figure 4 shows kernel density estimates for opposing and supporting towns' distance. Opposing towns were more concentrated around 20 miles.

A key difference between opposing and supporting towns was their location in upstream or downstream areas. To illustrate, I create an indicator for whether any town is downstream or upstream from the candidate town. The methodology is again illustrated by Figure 3. Towns strictly in the northeast plane of Northampton are downstream (i.e. towards the navigation head Peterborough) and towns in the southwest plane are upstream.[10] Panel (*b*) of Table 3 shows that the mean of the

[9] There were 160 towns matched to supporting petitions for the 69 bills and 88 towns matched to opposing petitions for the 69 bills. Ten towns were matched to a supporting and an opposing petition.

[10] A straight line is drawn from the candidate town (Northampton) to the navigation head (Peterborough). A perpendicular line is created to divide the upstream plane away from the navigation head (southwest of Northampton) and a downstream plane towards the head (northeast of Northampton). An upstream and downstream region is then created with a circle of potentially varying size centred on the candidate town. In the case of Figure 3, a circle with a radius of 25 miles identifies all towns in the upstream and downstream region for Northampton.

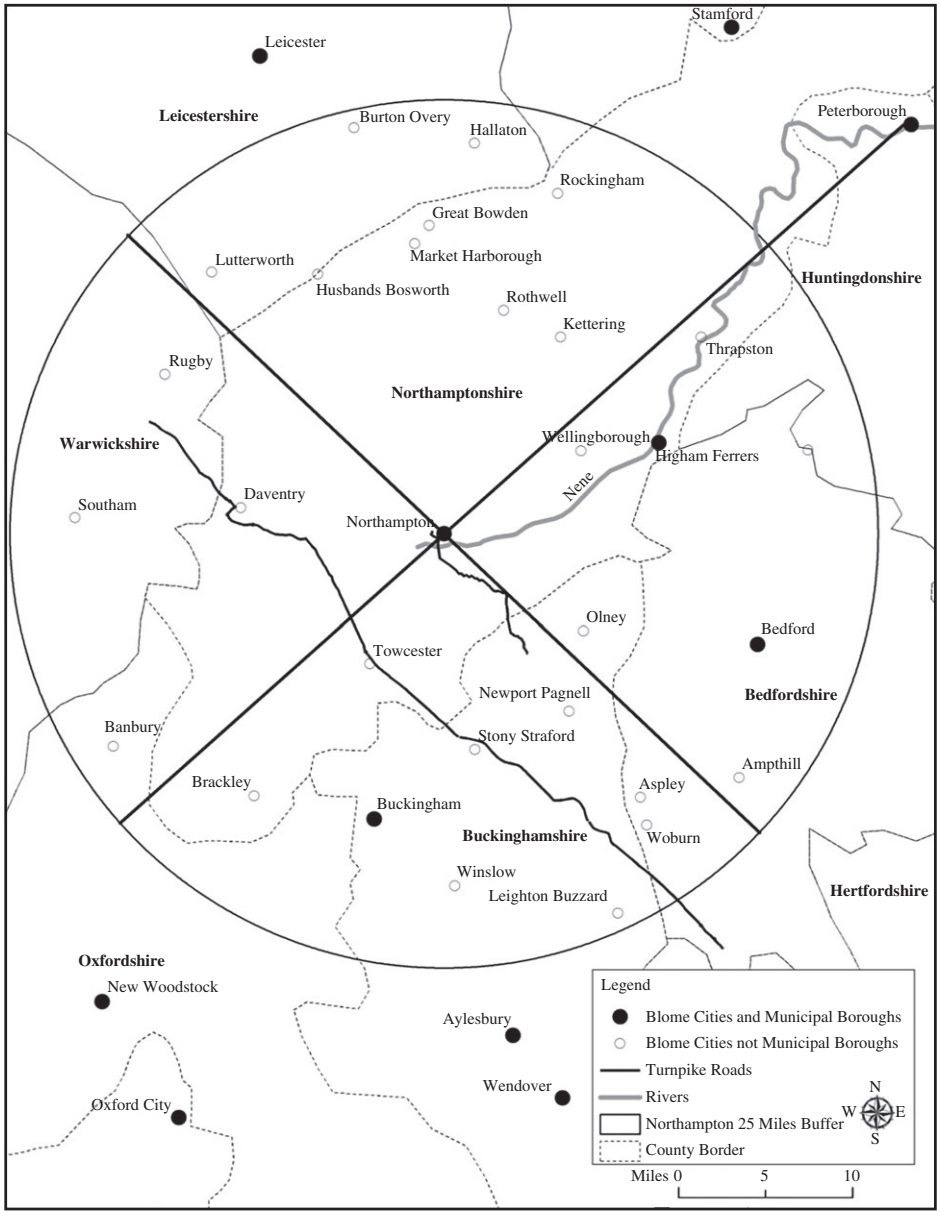

Fig. 3. *Towns and Features Near Northampton and the River Nene*

Source. See text.

downstream indicator is significantly lower for supporting towns compared to opposing towns.[11] The pattern holds if the candidate town is dropped rather than being upstream.

[11] Ten towns recorded as having a petition in support and against are dropped for this test leaving 228 towns in total.

Table 3

Summary of Towns Opposing and Supporting Bills

Panel (a): Petitioning towns location relative to bill's most downstream candidate town

Average distance to candidate town if supporting (SD)	22.8 miles (25.1)
Average distance to candidate town if opposing (SD)	20.0 miles (14.7)

Panel (b): Petitioning towns' downstream location relative to bill's candidate town

	Candidate town upstream			Candidate town is dropped		
	Petitioning town means if			Petitioning town means if		
Variables	Supporting	Opposing	p-value	Supporting	Opposing	p-value
Indicator for downstream from candidate town	0.20	0.64	0.00	0.25	0.67	0.00
N	150	78		120	75	

Notes. p-Value is for null hypothesis of equal means assuming equal variances. For sources see text.

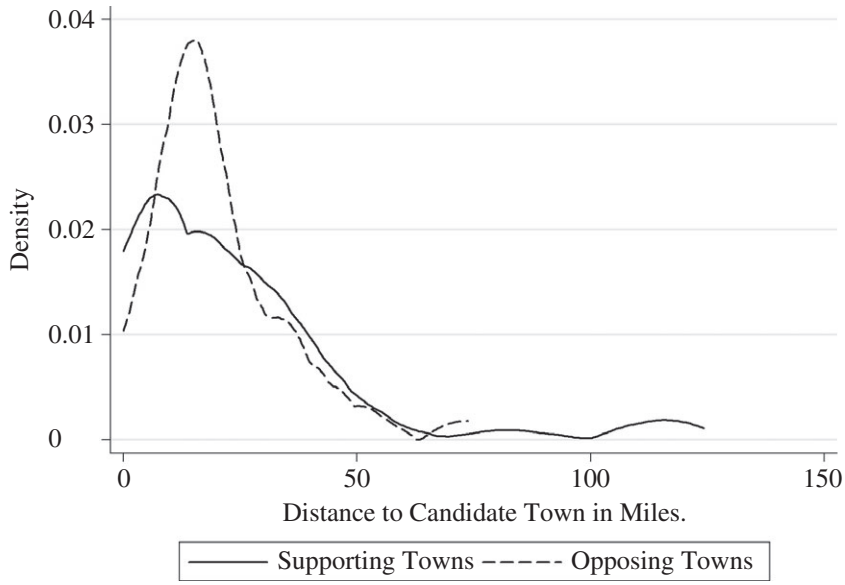

Fig. 4. *Supporting and Opposing Town's Distance to Candidate Towns: Kernal Densities*
Source. See text.

The analysis below builds on these patterns by using variables for the characteristics of towns in upstream and downstream areas within 25 miles. The variables capture the structure of interest groups in areas most likely to support or oppose a town's river bill. Similar variables are created for upstream and downstream majority party MPs to capture political connections. The following section describes models for analysing the diffusion of river acts and approval of bills.

3. Modelling the Diffusion of River Acts and the Success of River Bills in Parliament

The diffusion of river acts across candidate towns and parliaments is analysed using a discrete time hazard model. The discrete time model comes from a more general literature analysing an individual's transition to an absorbing state.[12] A classic example is the outcome of death for a patient, perhaps following treatment for disease. In the technology diffusion literature, the discrete time hazard model builds on a threshold utility model where a firm's profits must exceed a threshold level for them to adopt an irreversible technology.[13]

The threshold utility model is applied to this setting assuming towns have a utility from getting river acts. Let $y^*_{it} = \boldsymbol{\beta X}_{it} + \varepsilon_{it}$ be the utility to candidate town i if it gets a river act in parliament t, $\boldsymbol{X}_{it}$ is a vector of variables, $\boldsymbol{\beta}$ is a vector of coefficients, and ε_{it} is an error term. Assuming the alternative of no act yields zero utility, the town will seek an act if $y^*_{it} > 0$ or $\boldsymbol{\beta X}_{it} > -\varepsilon_{it}$. Defining the variable y_{it} equal to 1 if $y^*_{it} > 0$, and 0 otherwise, and assuming the error term ε_{it} is distributed standard normal yields the equation:

$$\text{Prob}(y_{it} = 1) = \Phi(\boldsymbol{\beta X}_{it}). \tag{1}$$

In terms of estimation y_{it} equals 1 if town i adopts a river act in parliament t and 0 otherwise. Note that town i is dropped in parliament t if it had a river act in any previous parliament. No town had more than one river navigation act and river acts were irreversible. Also note that the normality assumption is not crucial. Logit and linear models can also be considered.

The variables in $\boldsymbol{X}_{it}$ come under several sub-labels including $town_i$, $neighbour_i$, $geography_{it}$, $political_{it}$, $otheracts_{it}$, $whig_t$, $region_i$, $year_t$, $region_i \times year_t$. $town_i$ is a vector of characteristics that pre-exist the era of navigation improvements and are meant to capture the town's economic returns from getting river acts. It includes the town's market potential and other economic indicators described in the next section. The vector $neighbour_i$ has similar characteristics for upstream and downstream towns within 25 miles. $geography_{it}$ includes elevation change and distance to the navigation head. Note that geography has a time subscript because as other towns closer to the navigation head got river acts the distance declined and the elevation changed. $political_{it}$ has characteristics for upstream and downstream political constituencies within 25 miles in parliament t. A key characteristic is the number of majority party MPs downstream as it will capture the political connections of likely opponents. Other key variables are the number of majority party MPs in town i's county and in its closest constituency. $otheracts_{it}$ is the number of towns within 25 miles with river or turnpike acts at the start of parliament t. Turnpike acts were similar to river navigation acts except they improved roads by introducing tolls. I include neighbouring river and turnpike acts to capture network effects. $whig_t$ is an indicator for parliaments with Whig majorities, and captures the effect of which party was in power. $year_t$ is the year the current parliament ended, and is a time control. $region_i$ is a vector of indicators for whether the town is in the Southwest, East Midlands, West Midlands, North, or Wales region (the

[12] Singer and Willett (2003) and Allison and Christakis (2006) summarise models of event occurrence including the discrete time hazard models.

[13] For an overview of technology diffusion models and the threshold utility approach see Geroski (2000).

Southeast is omitted). They control for fixed unobservable factors across regions. Finally, $region_i \times year_t$ is a vector of region-specific time trends. They allow some regions to become more attractive for river navigation with time.

In terms of identification, many of the variables in (1) are exogenous. For example, the variables in $town_i$ and $neighbour_i$ are determined long before river acts became an issue. However, numbers of majority party MPs were political outcomes and thus they might be correlated with omitted variables. In Section 8, I address this concern using fixed effects models and variation in majority party representation coming from incumbent MPs.

In the second model, I analyse the parliament's decision to approve or reject bills. The model is of special interest because it speaks to the role of interest group pressures and party connections in parliament. I model bill 'success' by assuming that candidate town i has introduced a bill in parliament t and letting $s^*_{it} = \boldsymbol{\beta}_S \boldsymbol{X}_{Sit} + \varepsilon_{Sit}$ be the utility to parliament if town i's bill is successful in parliament t. Assuming the alternative yields zero utility, parliament will pass a bill if $s^*_{it} > 0$ or $\boldsymbol{\beta}_S \boldsymbol{X}_{Sit} > -\varepsilon_{Sit}$. Defining the variable s_{it} equal to 1 if town i has a successful river bill in parliament t and 0 otherwise, and assuming the error term ε_{it} is distributed standard normal, gives the equation, $\text{Prob}(s_{it} = 1) = \Phi(\boldsymbol{\beta}_s \boldsymbol{X}_{Sit})$.

There are several issues in analysing the bill success equation. First, it is an open question what factors influenced parliament's decision making and thus what variables should be included in $\boldsymbol{X}_{Sit}$. One theory mentioned earlier is that parliament was influenced by politics, which motivates the inclusion of variables in $political_{it}$ and $whig_t$. Another theory emphasises interest group pressures. The variables in $neighbour_i$, such as the number of neighbouring towns with manufacturing, should capture the influence of local interest groups. The market potential variable measures the candidate town's influence and surrounding towns. There is a possibility of opposition from competing transport projects, which motivates the inclusion of turnpike acts in nearby towns. Project feasibility is another factor and is best captured by the geographic variables, like elevation change and distance to the navigation head.

A second issue in the success function concerns selection bias, where bills arriving in parliament have unobservable characteristics correlated with variables determining success. I address this issue by estimating a bivariate probit model with sample selection.[14] There are two outcomes corresponding to the decision by towns to introduce bills and the success or failure of bills once in parliament. Importantly, the bivariate probit model allows for a correlation in unobservable factors across the two equations. As shown in online Appendix B.6, there is no evidence for a significant correlation lessening concerns about selection.

4. Summary Data on the Characteristics of Towns

Candidate town characteristics are created using several sources. From Blome's description, I create indicators for whether the town had manufacturing, had mining,

[14] The bivariate probit is often used in health economics where there are multiple binary outcomes, like switching insurance companies and purchasing supplementary insurance, see French and Maclean (2006) and Dormont *et al.* (2009). Greene (2008) provides an overview of discrete choice modelling including reviewing the bivariate probit.

had a harbour, was on the main road network c. 1670 and had a free school. There is also an indicator for whether the candidate town had municipal government, which, for simplicity, is one if the town had at least one type of official like mayors or council members.[15]

Population is an important town characteristic omitted from Blome's summary but fortunately there is an alternative source. I linked the towns in Blome with 1670 parish population estimates provided by the Cambridge Group for the History of Population and Social Structure.[16] The details of the linking are described in online Appendix A. The town population data is used to construct a 'local' market potential variable for each town, measuring the size of the town and its nearby neighbours that could use the waterway network. The local market potential for town i is $\sum_{j=1}^{782} Pop_j/d_{ij}$, where Pop_j is the population of town j (in tens of thousands) and d_{ij} is the Euclidean distance between town i and town j.[17]

As a preview, the first columns of Table 4 show summary characteristics for candidate towns adopting or not adopting river acts by 1741.[18] Several significant differences are revealed. Towns with river acts by 1741 have smaller elevation changes to their navigation head and higher local market potential than towns that did not get acts by 1741. Also towns with river acts were more likely to have municipal government, manufacturing, a harbour, or to be on the main road network. All of these patterns are sensible.

The second group of columns in Table 4 report the mean characteristics of candidate towns ever getting or ever not getting river acts by 1741 given they had at least one bill by 1741. Here there are fewer significant differences. Towns that did not get river acts, had greater elevation changes to the navigation head and were less likely to have municipal government but these mean differences are significant only at the 10% level. Thus, on the whole, the geographic and economic characteristics of towns cannot obviously explain why some towns with bills were blocked from river acts before 1741. The last columns in Table 4 report summary statistics for towns with river bills that did or did not succeed on the first try given the town eventually got an act by 1741. Again the geographic and economic characteristics of towns cannot obviously explain delays in getting river acts.

5. Summary Data on Neighbouring Town and Constituency Characteristics

Most of the neighbouring characteristics are defined in upstream and downstream areas within 25 miles. Specifically, there are variables for the number of towns with mining, manufacturing, water navigation c. 1670, municipal government and free schools in both upstream and downstream areas within 25 miles. Most of these characteristics are associated with a higher likelihood of a town ever supporting or ever

[15] For roads I supplemented Blome with Robert Morden's, *The New Description of the State of England*. Morden (1701) provides maps of roads in each county in the seventeenth century before turnpikes.

[16] I thank Leigh Shaw Taylor for kindly sharing the data.

[17] The sum is over all 782 towns in the Blome list. The distance between town i and itself is taken to be $0.333*\sqrt{(1/\pi)}$ following the convention adopted by Keeble *et al.* (1982) to measure the market potential of regions.

[18] Summary statistics on town characteristics for candidate towns are provided in online Appendix B.1.

Table 4

Characteristics for Candidate Towns with River Acts and Successful Bills by 1741

	All candidate towns			Candidate towns with river bill			Candidate towns who got act by 1741		
	Candidate town means if			Candidate town means if			Candidate town means if		
Variables	River act by 1741	No river act by 1741	p-value	River act by 1741	No river act by 1741	p-value	Bill succeeds first try	Bill fails first try	p-value
Elevation change to navigation head in 10 ft.	5.97	16.14	0.00	5.97	8.74	0.08	5.91	6.05	0.91
Distance to navigation head in 10 miles	2.73	3.25	0.14	2.74	2.71	0.95	2.81	2.66	0.80
Local market potential (10,000s)	2.31	1.64	0.00	2.31	2.37	0.91	2.47	2.14	0.41
Has municipal govt.	0.47	0.19	0.00	0.47	0.26	0.09	0.37	0.58	0.13
Has manufacturing	0.37	0.2	0.01	0.37	0.30	0.57	0.30	0.46	0.24
Has mining	0.04	0.04	0.92	0.04	0.00	0.34	0.04	0.04	0.93
Has harbour	0.04	0.01	0.05	0.04	0.00	0.34	0.04	0.04	0.93
On main road network	0.80	0.61	0.01	0.80	0.70	0.31	0.78	0.83	0.63
Has a free school	0.12	0.08	0.3	0.12	0.05	0.32	0.19	0.04	0.12
N		435			74			51	

Notes. p-Value is for null hypothesis of equal means assuming equal variances. For sources see text.

opposing a bill through a petition. Moreover, some are more associated with supporting petitions than opposing petitions in upstream and downstream areas.[19] For example, a petitioning town is more likely to support a bill if it is upstream and on the main road network or if it is downstream and has water navigation c. 1670. Thus, I capture the influence or strength of interest groups most likely to support by summing over the number of upstream towns on the road network and the number of downstream towns with water navigation *c.* 1670. Other variables, like the population of the town at the navigation head, capture the influence of towns most likely to oppose.

Related variables are created for the characteristics of political constituencies and their MPs upstream and downstream within 25 miles. In England and Wales from 1690 to 1741, there were 53 county constituencies and 220 municipal boroughs. Most county and borough constituencies were represented by two MPs but there were some with one or four. To locate these constituencies in space, the latitude and longitude of

[19] Table B2 in the online Appendix reports difference-in-means tests for towns supporting or opposing bills. Table B3 analyses whether petitioning towns support or oppose as a function of location and economic characteristics.

boroughs is taken from the towns in Blome identified as boroughs. The latitude and longitude of counties are given by the latitude and longitude of their most central point. In Figure 3 towns near the river Nene with dark-filled circles are boroughs represented in the Commons and dashed lines mark county boundaries.

The party affiliation of MPs in each constituency is taken from new data. The majority party in each parliament is available in the House of Commons series (Sedgwick, 1970; Cruickshanks *et al.*, 2002) but until recently there were no data for the party affiliation of every MP in each parliament. Elsewhere, I detail how to identify whether each MP was affiliated with the Whigs or Tories when they had a majority in the Commons for all parliaments from 1690 to 1747 (Bogart, 2016). The political classification draws on division lists that identify party affiliation directly or by voting on major pieces of legislation associated with the leaders of the two parties. The party-MP data are used to measure the number of majority party MPs across constituencies for every parliament.[20] Party affiliation is then projected in space, using the coordinates of constituencies. Online Appendix A illustrates the variation in party representation for the 1708 and 1710 parliaments when the Whigs and then Tories were in the majority.

The variation in party representation across time and space is crucial to this article. For each candidate town, I create a list of party connection variables including the number of majority party MPs in their county, in their closest constituency and the number of majority party MPs in their downstream or upstream areas within 25 miles. As neighbouring MP and constituency characteristics could also matter, similar variables are created for the number of MPs, incumbent MPs and constituencies with electoral contests within 25 miles, both upstream and downstream.[21] The number of MPs serves as a control variable as some areas had more representation and hence more majority party MPs and incumbents.

Finally, to capture network effects, I count the number of towns within 25 miles that had river acts and turnpike acts by the end of the previous parliament. Blome towns are matched to turnpike acts using similar sources. Figure 3 shows a turnpike road connecting to Northampton.

The top panel in Table 5 previews the most important differences in means for neighbouring town variables.[22] The results show that if more upstream towns within 25 miles were on the main road network c. 1670 then candidate towns were more likely to get acts by 1741. Having more downstream towns with harbours or with municipal government made a town significantly less likely. Most of the same neighbouring town characteristics are correlated with towns having bills succeed in parliament given they had at least one bill. One difference is that a town's bill was

[20] Note that some constituencies have more than one MP in a parliament due to deaths or exits. Here the number of majority party MPs is the monthly average across MPs who sat in a parliament.

[21] A contest involved two or more candidates for the same seat in the Commons and provides an indicator of local political competition. Contests are documented in the House of Commons 1690–1715 and the House of Commons 1715–1754 (Sedgwick, 1970; Cruickshanks *et al.*, 2002). The History also documents the political tenure of each MP in a constituency. An incumbent is defined as an MP that served two consecutive parliaments in the same constituency. I also require that the MP serve the full term of both parliaments and not take over because the death of another MP.

[22] Summary statistics for neighbouring town characteristics are shown in online Appendix Table B1.

Table 5

Preview of Significant Neighbouring Town and Constituency Characteristics

Panel (a): Characteristics in neighbouring towns and indicators for getting river acts

	All candidate towns			Candidate towns with river bill		
	Town means if			Town means if		
Variables	River act by 1741	No river act by 1741	p-value	River act by 1741	No river act by 1741	p-value
Towns on road network upstream, 25 miles	10.27	8.03	0.01	10.27	6.82	0.01
Towns with municipal govt. downstream, 25 miles	2.15	2.71	0.02	2.16	2.65	0.14
Towns with harbours downstream, 25 miles	0.33	0.61	0.05	0.33	0.91	0.00
Towns with water navigation c. 1670 downstream, 25 miles	2.80	2.27	0.31	2.80	1.35	0.03
Population of navigation head in 1,000s	1.95	2.11	0.68	1.95	4.26	0.00
N			435			74

Panel (b): Turnpike acts, Whigs, downstream majority MPs and indicators for river acts and bills by parliament

	All candidate towns			Candidate towns with river bill		
	Town means if			Town means if		
Variables	River act in parliament	No river act in parliament	p-value	River act in parliament	No river act in parliament	p-value
Towns with turnpike acts, 25 miles	4.35	1.53	0.00	4.35	1.66	0.05
Majority party MPs downstream, 25 miles	2.66	3.86	0.01	2.66	3.73	0.01
Parliaments with whig majority	0.8	0.56	0.00	0.80	0.66	0.10
N			5,813			107

Source. See text.

more likely to succeed if more of its downstream towns within 25 miles had water navigation c. 1670, or if the navigation head had lower population. Several of these results match the findings mentioned earlier that upstream towns on the road network and downstream towns with water navigation were more likely to petition in support of bills rather than against.

The bottom panel of Table 5 previews the correlations for variables that vary across the 14 parliaments from 1690 to 1741. Towns getting river acts in a parliament had significantly fewer downstream majority party MPs within 25 miles. The same is true of candidate towns with successful river bills in a parliament. Other notable findings are that towns with river acts in a parliament had more turnpike acts in neighbouring towns. Also towns were significantly more likely to get river acts in parliaments with a Whig majority. These same patterns are now examined using the econometric models described in Section 3.

6. Results I: The Adoption of River Acts

The coefficient estimates for the baseline probit model are reported in Table 6 along with robust standard errors clustered on candidate towns.[23] Several geographic and town variables are statistically significant. The same applies to several neighbouring town and majority party variables.[24] Table 7 summarises the magnitudes for the most precisely estimated coefficients by reporting the adjusted predicted probability of an act at representative 'low' and 'high' values. For continuous variables the representative values are one standard deviation below and above the mean. For indicator variables, a 0 or 1 is used as the representative value. All other variables are kept at their original values. Thus, the adjusted predicted probability of an act is made assuming all candidate towns have the low representative value and again assuming they all have the high representative value. Readers should note that the probability of a town getting an act in any given parliament was quite low ($p = 0.009$) and even if a variable has a large effect it will not make the overall probability large. Thus the magnitudes are better represented by the percentage change in the adjusted predicted probabilities at the representative low and high values (shown in the last column of Table 7). A 95% confidence interval is also reported to show the precision of the predicted probabilities.

One key finding is that majority party connections of river act supporters and opponents had large effects. County MPs represented the economic interests of the region surrounding a river project and were more likely to support river projects. Having high majority party MPs in the town's county constituency increased the probability a town adopted an act by 116% compared to having low majority party MPs in the county. Downstream majority MPs often represented river navigation opponents. Moving from a low to a high value for the number of majority party MPs downstream within 25 miles lowered the probability of act by 88%. Another interesting finding is that towns had a 160% higher probability of getting a river act under a Whig majority in the Commons compared to a Tory majority. This finding supports the view that Whig majorities were more conducive to development.

The majority party variables have significant effects but they were not as large as the effects of geography or town characteristics. If a town's elevation increased from a low to a high value its probability of adoption decreased by nearly 100%. Clearly the feasibility of projects, especially the problems with elevation changes, mattered a lot. Distance to the navigation head was very important. Increasing the distance from low to high raised the probability of an act by just over 900%. Project scale is the most likely explanation for this result. A river with a greater distance meant that the fixed costs of bringing a bill into parliament, getting it passed and implementing the project could be spread across more users. Towns with manufacturing and with municipal governments were 107% and 156% more likely to get an act compared to towns without these characteristics. Increasing local market potential from a low to a high

[23] Note that observations for Wales are dropped in the probit model as there are no river acts. Thus, the sample size in terms of candidate town-parliament observations drops to 5,393.

[24] There might be a concern that the standard errors are understated for geography, town characteristic and neighbouring town variables because they do not vary across parliaments. As it turns out, this is not a problem. The signs and significance of these variables are generally similar after estimating a probit model but restricting the sample to a single year and analysing which of 435 candidate towns ever adopted river acts.

Table 6

Coefficient Estimates: Baseline Probit Model for Adoption of River Acts in a Town

Variables	Coefficient (SE)	Variables	Coefficient (SE)
Geographic variables			
Elevation change to navigation head	−0.140*** (0.0216)	Distance to navigation head	0.362*** (0.0748)
Town characteristics			
Has harbour	0.487 (0.384)	Has manufacturing	0.382** (0.183)
Has mining	0.629 (0.439)	On main road network 17c.	−0.108 (0.179)
Has free school	0.0116 (0.230)	Local market potential (10,000s)	0.231*** (0.0548)
Has municipal govt.	0.492*** (0.161)		
Neighbouring town characteristics			
Towns w/harbours up, 25 miles	−0.00982 (0.147)	Towns w/mining up, 25 miles	−0.309** (0.128)
Towns w/harbours down, 25 miles	−0.163 (0.112)	Towns w/mining down, 25 miles	0.185* (0.102)
Towns w/manufact. up, 25 miles	−0.0141 (0.0358)	Towns w/water nav. 1670 up, 25 miles	−0.167** (0.0708)
Towns w/manufact. down, 25 miles	0.0861* (0.0506)	Towns w/water nav. 1670 down, 25 miles	0.105* (0.0566)
Towns on road network up, 25 miles	0.0488* (0.0255)	Towns w/free schools up, 25 miles	0.00104 (0.0753)
Towns on road network down, 25 miles	−0.0454* (0.0275)	Towns w/free schools down, 25 miles	0.0131 (0.0822)
Towns w/munic. govt. up, 25 miles	0.0182 (0.0753)	Pop. of navigation head in 1,000s	−0.0763** (0.0371)
Towns w/munic. govt. down, 25 miles	−0.162** (0.0763)		
Neighbouring political constituencies			
MPs up, 25 miles	−0.0921** (0.0379)	Majority party MPs county	0.259** (0.103)
MPs down, 25 miles	0.0759** (0.0369)	Majority party MPs closest constituency	−0.143 (0.0916)
Majority party MPs up, 25 miles	0.0738* (0.0425)	Constituencies w/contests up, 25 miles	0.0764 (0.0644)
Majority party MPs down, 25 miles	−0.177*** (0.0429)	Constituencies w/contests down, 25 miles	−0.0795 (0.0652)
Incumbent MPs up, 25 miles	0.0313 (0.0327)	Incumbent MPs down, 25 miles	−0.0009 (0.0325)
Majority party			
Whig majority indicator	0.471*** (0.151)		
Other Acts by start of current parliament			
Towns with turnpike acts, 25 miles	0.0311* (0.0187)	Towns with river acts, 25 miles	−0.00699 (0.0478)
Region indicators			
North	16.21 (30.86)	West Midlands	63.08** (26.58)
East Midlands	43.85 (26.76)	Southwest	76.94** (34.44)

Table 6
(*Continued*)

Variables	Coefficient (SE)	Variables	Coefficient (SE)
Time and region trends			
Year	0.0392**	Year × East Midlands	−0.0253
	(0.0154)		(0.0156)
Year × North	−0.00922	Year × West Midlands	−0.0363**
	(0.0179)		(0.0154)
Year × Southwest	−0.0446**	Constant	−70.43***
	(0.0201)		(26.54)
Observations	5,393	Pseudo R^2	0.337

Notes. Robust standard errors are reported clustered on towns. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 7
Adjusted Probability of River Act for Selected Variables at Representative Low and High Values

	Variable low		Variable high		% change in probability
Variables	Average probability	[95% confidence interval]	Average probability	[95% confidence interval]	Low to high
Elevation change to navigation head	0.0898	[0.0481, 0.1316]	0.0001	[0.000, 0.0004]	−99.9
Distance to navigation head	0.0048	[0.0031, 0.0066]	0.0481	[0.0210, 0.0752]	902.1
Town, manufacturing	0.0076	[0.0051, 0.0100]	0.0157	[0.0075, 0.0238]	106.6
Town, municipal govt.	0.0068	[0.0042, 0.0095]	0.0174	[0.0102, 0.0246]	155.9
Local market potential	0.0055	[0.0033, 0.0077]	0.0130	[0.0092, 0.0167]	136.4
Pop. of navigation head in 1,000s	0.0134	[0.0081, 0.0186]	0.0068	[0.0037, 0.0098]	−49.3
Towns with mining up, 25 miles	0.0129	[0.0088, 0.0169]	0.0066	[0.0036, 0.0094]	−48.8
Towns with water nav. up, 25 miles	0.0144	[0.0082, 0.0205]	0.0058	[0.0028, 0.0087]	−59.7
Towns municipal govt. down, 25 miles	0.0143	[0.0075, 0.0212]	0.0052	[0.0021, 0.0083]	−63.6
Towns with turnpike acts, 25 miles	0.0080	[0.0056, 0.0104]	0.0116	[0.0070, 0.0161]	45.0
Whig majority indicator	0.0048	[0.0022, 0.0075]	0.0125	[0.0088, 0.0163]	160.4
Maj. party MPs county	0.0068	[0.0041, 0.0094]	0.0147	[0.0089, 0.0205]	116.2
Maj. party MPs down, 25 mi.	0.0220	[0.0119, 0.0321]	0.0026	[0.0009, 0.0044]	−88.2
N					5,393

Notes. The adjusted probability is the average predicted probability across all candidate towns when a variable is changed but all other variables are kept same. Low is one standard deviation below the mean (or 0 for dummy variables) and high is one standard deviation above mean (or 1 for dummy variables). All calculations are done, using the Margins command in Stata.

value increased the probability of an act by 136%. Greater demand for transport improvements is the most likely explanation for the local market potential and manufacturing results. The municipal government result is interesting from a

collective action perspective. Towns with municipal government could more easily form coalitions, giving them an organisational advantage.

The effects of neighbouring town characteristics were generally smaller in magnitude but there are several significant results. A higher population for the town at the navigation head lowered the probability of an act. The same applies to having more downstream towns with municipal government, more upstream mining towns, and more upstream towns with water navigation c. 1670. Several of these factors, like the higher population of towns at the navigation head and downstream towns with municipal government, are indicative of the strength of opposing groups and their role in slowing the diffusion of acts.

Turnpike road improvements in nearby towns also significantly increased the probability of adopting river acts. The most likely explanation is network effects. New roads were often complementary to improvements in inland water navigation, as has been shown for turnpike and canals acts in the late 1700s (Bogart, 2009).

Before concluding this Section, three remarks should be made on the sensitivity of the results. First, the Whig majority dummy remains positive and significant even after including time varying macro-economic controls.[25] Thus it is unlikely that the effect is related to Whig majorities occurring in years more favourable to development. Second, most of the results are not sensitive to the choice of 25 miles as the spatial scale for interest group and party connections. The magnitude and significance of only a few variables change if all neighbouring characteristics are specified as upstream and downstream within 20 or 30 miles.[26] Third, the distinction between upstream and downstream areas matters. To examine this issue, I draw a line between the candidate town and its navigation head as before but then I divide the plane into towns that were to the left and right of the candidate town. Left and right distinctions should not matter, or at the very least they should have smaller and less precise effects than upstream and downstream distinctions. The result of a 'placebo' analysis using left/right variables shows that few of these alternatives significantly influenced the adoption of river acts.[27]

7. Results II: River Bill Success

The success or failure of river bills in parliament is another outcome of interest. Table 8 shows the coefficient estimates and robust standard errors for the probit model examining bill success. The number of majority party MPs representing the county and the number of majority party MPs downstream are significant. The signs are consistent with the model for adopting river acts. Several other variables are also

[25] The time-varying controls include the inflation rate, rates of return on land, indicators for harvest failures, indicators for years of war, the growth rate of coastal trade and the length of parliamentary sessions (see Bogart, 2011). I average these variables across a parliament and include them in the probit model for river act adoption. Results are shown in online Appendix Table B4.

[26] The main differences are that at 20 miles neighbouring towns with river navigation, upstream towns on the road network and downstream towns with municipal government are now insignificant. For 30 miles, upstream contests are now positive and significant, and neighbouring towns with mining and downstream towns with municipal government are insignificant. See online Appendix Table B5 for details.

[27] The results of the left/right placebo test are shown in online Appendix Table B6.

Table 8

Coefficients for River Bill Success Function: Probit Model

Variables	Coefficient (SE)	Variables	Coefficient (SE)
MPs up, 25 miles	−0.0358	Towns w/harbours down, 25 miles	−1.121***
	(0.124)		(0.343)
MPs down, 25 miles	0.161	Towns w/mining up, 25 miles	−0.293
	(0.175)		(0.387)
Majority party MPs county	1.075***	Towns w/mining down, 25 miles	0.500*
	(0.401)		(0.300)
Majority party MPs closest constituency	−0.450	Towns w/manufacturing up, 25 miles	0.139
	(0.347)		(0.165)
Majority party MPs up, 25 miles	0.0837	Towns w/manufacturing down, 25 miles	0.330*
	(0.162)		(0.170)
Majority party MPs down, 25 miles	−1.032***	Towns w/water nav. 1670 up, 25 miles	−0.654***
	(0.281)		(0.251)
Constituencies w/contests up, 25 miles	−0.193	Towns w/water nav. 1670 down, 25 miles	0.575***
	(0.203)		(0.182)
Constituencies w/contests down, 25 miles	0.141	Towns on road network up, 25 miles	0.227**
	(0.227)		(0.111)
Incumbent MPs up, 25 miles	0.254*	Towns on road network down, 25 miles	0.238*
	(0.131)		(0.123)
Incumbent MPs down, 25 miles	0.152	Towns w/free schools up, 25 miles	0.542*
	(0.165)		(0.318)
Whig majority indicator	0.941	Towns w/free schools down, 25 miles	−0.164
	(0.682)		(0.287)
Elevation change to navigation head	−0.186**	Towns w/municipal govt. up, 25 miles	0.325
	(0.0792)		(0.236)
Distance to navigation head	0.811***	Towns w/municipal govt. down, 25 miles	−0.527
	(0.235)		(0.397)
Local market potential (10,000s)	0.510**	Towns with turnpike acts, 25 miles	−0.180**
	(0.213)		(0.0880)
Pop. of navigation head in 1,000s	−0.157*	Year	0.0891***
	(0.0875)		(0.0236)
Towns w/harbours up, 25 million	2.249***	Constant	−160.1***
	(0.612)		(41.81)
Pseudo R^2	0.575	Observations	107

Notes. Robust standard errors are reported. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

significant. These include elevation, distance to the navigation head, local market potential, the population of the navigation head and upstream or downstream towns with harbours, water navigation and main roads.[28]

Note that some factors affecting river acts are less relevant to the success of river bills. For example, Whig majorities do not have a significant effect on bill success. This finding suggests that Whig majorities contributed to river acts for reasons other than the Whigs favourability to the approval of river bills. Other variables have the opposite sign in the success equation. For example, turnpike acts have a negative sign, suggesting there may have been opposition by competing road authorities, even as they complemented a town's river improvements.

[28] In online Appendix B.6, I also estimate a bivariate probit model. The results are similar for many key variables. See online Appendix Table B7.

Table 9

Adjusted Probability of Successful River Bill for Selected Variables at Representative Low and High Values

	Variable low		Variable high		% change in probability
Variables	Average probability	[95% confidence interval]	Average probability	[95% confidence interval]	Low to high
Elevation change to navigation head	0.6265	[0.5235, 0.7295]	0.3306	[0.2306, 0.4305]	−47.2
Distance to navigation head	0.3003	[0.2292, 0.3714]	0.7054	[0.6089, 0.8018]	134.9
Local market potential	0.3594	[0.2715, 0.4473]	0.6097	[0.4951, 0.7244]	69.6
Towns with water nav. up, within 25 miles	0.5462	[0.4824, 0.6100]	0.3339	[0.2511, 0.4168]	−38.9
Towns with water nav. down, within 25 miles	0.3046	[0.2150, 0.3942]	0.6838	[0.5837, 0.7838]	124.5
Towns with harbours up, within 25 miles	0.4185	[0.3612, 0.4758]	0.7190	[0.6452, 0.7928]	71.8
Towns with harbours down, within 25 miles	0.5687	[0.4970, 0.6405]	0.3489	[0.2864, 0.4113]	−38.6
Towns on road network up, 25 miles	0.3396	[0.2411, 0.4382]	0.6707	[0.5131, 0.8282]	97.5
Maj. party MPs county	0.3639	[0.2996, 0.4283]	0.5977	[0.5042, 0.6912]	64.2
Maj. party MPs down, within 25 miles	0.7826	[0.6991, 0.8663]	0.2084	[0.1538, 0.2630]	−73.4
Year parliament ended	0.2832	[0.2059, 0.3604]	0.6152	[0.5425, 0.6879]	117.2
N					107

Notes. The adjusted probability is the average predicted probability across all candidate towns that had river bills when a variable is changed but all other variables are kept same. Low is one standard deviation below the mean (or 0 for dummy variables) and high is one standard deviation above mean (or 1 for dummy variables). Note a low 'year parliament ended' is 1695 and a high year is 1722. All calculations are done, using the Margins command in Stata.

The magnitudes of the most precisely estimated variables affecting bill success are illustrated in Table 9. It reports the adjusted predicted probability at representative low and high values for the 107 candidate towns matched to bills. The probabilities are also averaged over the 107 candidate towns. Having high majority party MPs in the county raised the likelihood of bill success by 64%. High majority party MPs downstream reduced the likelihood of success by 73%. The sizeable effects of majority party MPs point to the significance of party connections.

Neighbouring town characteristics also had sizeable effects. More downstream towns with water navigation raised the likelihood that bills would succeed by 124%. Similar magnitudes apply to variables for upstream towns with harbours and upstream towns on the road network. Such neighbouring towns were likely to be supportive of extending river navigation, suggesting that the influence of neighbouring towns most favourable to river bills encouraged their success in parliament. Another interesting finding is that more harbour towns downstream significantly

lowered the probability of a bill succeeding. The *Journals of the Commons* have several petitions from harbour towns arguing that navigation improvement upstream will negatively affect them.[29] The results suggest their influence could work against extending river navigation.

There are other findings of note. Moving from low to high values of local market potential increased the probability of success by nearly 70%. The most natural interpretation is that lobbying by populous candidate towns increased the chances of their bill's success. Also, moving from lower to higher elevation changes decreased the probability by 47% and moving from lower to higher distances to the navigation head increased the probability by 149%. It would appear that parliament considered the feasibility and scale of projects. A last notable finding relates to the greater likelihood of success over time. The predicted probability of a bill succeeding in 1722 was 117% higher compared to 1695 (see the last entry of Table 9). It appears that parliament got better in passing river bills and perhaps better in resolving conflicts among various interest groups.

Overall the estimates suggest that geographic factors along with neighbouring town characteristics and MP party connections affected the success of bills in parliament. A natural follow up question is whether these characteristics delayed bills from succeeding or whether they contributed to river bills being blocked. To address this question, I estimate counter-factual probabilities of bill success for the 23 towns that had river bills before 1741 but zero acts before 1741. Recall that most of these towns eventually got navigation acts but not for many decades. A counter-factual is conducted for the key variables in the bill success equation. It is assumed the 23 blocked towns have the average value of the 51 towns with successful river bills before 1741. A comparison is then made with the average value in the 23 blocked towns for each key variable. The sample size of blocked towns is smaller and thus the precision of the predicted probabilities is not as high as before but the calculations still yield insights.

The results on blocking are shown in Table 10. Neighbouring town characteristics had the largest effect on blocking. Specifically, if blocked towns had fewer towns with water navigation upstream and fewer with harbours downstream, as did towns with successful bills, their chances of having a successful river bill in parliament would have gone up by 59–70%. Similarly if they had more towns with water navigation downstream and more on the main road network upstream their chances would have increased by 74%. Several of these results suggest that if blocked towns had stronger interests supporting their bill and weaker interests opposing their bill their outcome could have been different. Regarding party connections, the size of the effect for downstream majority party MPs is smaller than for neighbouring towns but not trivial. If blocked towns had the same average downstream majority party MPs as successful towns then their chances of getting a successful bill would have increased by nearly 24%. This last result suggests that patterns of opposing party connections persisted for some towns and contributed to blocking. By comparison, the effect of the number of majority party MPs in the county is small.

[29] An example is Newcastle upon Tyne opposing the river Wear bill (see the *Journals of the House of Commons*, vol. 18, p. 516 (28 March 1717).

Table 10

Adjusted Probability of Successful River Bill for Selected Variables at Representative Values for Blocked Towns and Towns with Successful Bills

	Variable equal to mean for blocked town		Variable equal to mean for towns with successful bills		% change in probability
Variables	Average probability	[95% confidence interval]	Average probability	[95% confidence interval]	Low to high
Elevation change to navigation head	0.1518	[0.0666, 0.2370]	0.2093	[0.1223, 0.2962]	37.9
Distance to navigation head	0.2651	[0.1608, 0.3693]	0.2679	[0.1628, 0.3731]	1.1
Local market potential	0.4895	[0.4298, 0.5492]	0.4851	[0.4262, 0.5439]	−1.0
Towns with water access up, within 25 miles	0.1035	[0.0406, 0.1664]	0.1757	[0.1063, 0.2451]	69.8
Towns with water access down, within 25 miles	0.1674	[0.0832, 0.2515]	0.2917	[0.1787, 0.4047]	74.3
Towns with harbours up, within 25 miles	0.2069	[0.1162, 0.2976]	0.2319	[0.1396, 0.3243]	12.1
Towns with harbours down, within 25 miles	0.1428	[0.0762, 0.2094]	0.2270	[0.1421, 0.3118]	58.9
Towns on road network up, 25 miles	0.1729	[0.0791, 0.2667]	0.3013	[0.1292, 0.4743]	74.3
Maj. party MPs county	0.2394	[0.1405, 0.3383]	0.2226	[0.1289, 0.3162]	−7.0
Maj. party MPs down, within 25 miles	0.1717	[0.0973, 0.2462]	0.2122	[0.1275, 0.2968]	23.6
N					23

Notes. Blocked towns are those with river bills but no act by 1741 Calculations are the same as Table 9 except the first set of columns uses the average values from 1690 to 1741 for blocked towns by 1741. The second set of columns uses the average values for towns with successful river bills or acts by 1741.

Thus county party connections resulted in delays in getting river navigation acts, but not blocking.

8. Omitted Variables and Majority Party Connections

This Section addresses whether omitted factors bias the estimated relationship between the majority party MP variables and the adoption of acts. For example, one could argue that more educated or better funded towns could foresee which party would win a majority in the next election and could seek to elect a majority party MP; if so, majority party MPs' estimated effects reflect other factors than just party connections. I address this issue using fixed effects models and different sources of variation coming from incumbents and newly elected MPs. Town and parliament fixed effects (FEs) are useful because they control for time-invariant unobservable factors at the town level and time-varying factors common among all towns in a parliament. If the majority party variables are correlated with these unobservable factors then their magnitude should change with the addition of FEs. The first FE models take the following linear form:

$$y_{it} = \beta_1 political_{it} + \beta_2 geography_{it} + \beta_3 acts_{it} + \alpha_i + \delta_t + \varepsilon_{it} \quad (2)$$

Table 11

Fixed Effects Models for Adoption of River Acts

Variables	(1) Linear model Clustered SE	(2) Linear model Driscoll–Kraay SE	(3) Linear model PCSE with AR(1)	(4) Conditional FE logit model
Panel (a): FE model estimates				
Majority party MPs county	0.0051**	0.0051*	0.0040**	0.446
	(0.0022)	(0.0029)	(0.0018)	(0.429)
Majority party MPs closest constituency	−0.0015	−0.0015	−0.00093	−0.596
	(0.0018)	(0.0014)	(0.0012)	(0.513)
Majority party MPs up, 25 miles	0.0012*	0.0012	0.00010***	−0.122
	(0.00065)	(0.00090)	(0.00038)	(0.223)
Majority party MPs down, 25 miles	−0.0017**	−0.0017**	−0.0016***	−0.428**
	(0.00068)	(0.00064)	(0.00045)	(0.218)
Geography variables	Yes	Yes	Yes	No
Other acts, 25 miles	Yes	Yes	Yes	Yes
Contests and incumbents up, down, 25 miles	Yes	Yes	Yes	Yes
Town FE, parliament FE, region-specific trends	Yes	Yes	Yes	No
Town FE, whig majority indicator	No	No	No	Yes
Observations across all parliaments	5,813	5,813	5,813	437
R^2 (within)	0.031	0.031	0.163	
Number of towns	435	435	435	51
Panel (b): Adjusted probability of river act				
% change in average probability of act going from low to high county majority party MPs	170.2	170.2	76.1	
% change in average probability of act going from low to high downstream majority party MPs	−75.0	−75.0	−60.3	

Notes. The adjusted probability is the average predicted probability across all candidate towns when a variable is changed but all other variables are kept same. Low is one standard deviation below mean and high is one standard deviation above mean. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

where y_{it} is an indicator for whether town i got a river act in parliament t, $political_{it}$ and $geography_{it}$ are defined earlier, α_i is a town FE, δ_t is a parliament FE, and ε_{it} is an error term.[30] Three linear FE models are estimated under different assumptions about the standard errors. The first clusters standard errors on the town. The second computes Driscoll–Kraay standard errors which incorporate cross-sectional dependence (Driscoll and Kraay, 1998; Hoechle, 2007). The third uses panel corrected standard errors (PCSE) with an AR(1) disturbance term.

The results of the linear fixed effects models are shown in columns (1)–(3) in Table 11. The main findings are very similar across the three. The probability of an act increased significantly when a town had more county majority party MPs and the

[30] The FEs cannot be included in the probit model discussed earlier. FEs can be included in the linear probability model but at the cost of dropping $town_i$ and $neighbour_i$ which are fixed for a town across all parliaments.

probability decreased significantly when a town had more downstream majority party MPs within 25 miles. The bottom panel summarises the adjusted predicted probabilities for these two variables. Moving from low to high majority party MPs downstream decreases the probability of an act by 75% in the first two models and by 60% in the PCSE model. In the baseline probit model discussed above, the same change reduced the probability by 88%. The predicted probability when changing county majority party MPs varies across the specifications but is broadly similar to the probit model.

I also estimate a conditional fixed effects logit specification for comparison. In this model, the outcome of getting an act is correctly restricted to be 0 or 1 but there are some drawbacks.[31] Identification comes from variation only in the towns that got river acts and thus the sample size is smaller. Also parliament fixed effects cannot be estimated in this case. I address common time variation to some degree by including the indicator for Whig majority parliaments. The results are reported in column (4) of Table 11. The coefficient for downstream majority party MPs continues to have a significant and negative effect. The coefficient for county majority party MPs is positive but not significant.[32]

A different method confirms that downstream majority party MPs is the most robust of the majority party variables. It focuses on differences between incumbent and newly elected MPs. To build intuition, consider there were two ways that an MP in a constituency could be affiliated with the majority party in a parliament. First, the MP is an incumbent and the national electorate selects the incumbent's party in the most recent election. Second, the MP enters by winning the most recent election and he is affiliated with the party chosen by the national electorate. In the first case, local interests got an MP affiliated with the majority party because of country-wide majority party changes. In the second case, local interests got affiliation with the majority party by choosing a new MP. Given the greater activity of local interests in the second case, it is possible they were more likely to choose a majority party MP to help secure or defeat bills in the Commons. Thus one could interpret variation from newly elected majority party MPs as more likely to be endogenous and variation from incumbent majority party MPs as more exogenous.

I conduct tests by creating variables for majority party MPs that were incumbents.[33] All the specifications in Table 12 use the baseline probit model for the adoption of river acts. Column (1) only includes variables for incumbent majority party MPs. The sample size is smaller than before because all observations in the 1690 parliament must be dropped to define incumbent MPs from 1695 onwards. The results show that only the variable for downstream majority party MPs is significant. County majority party MPs has the same sign but is not significant. For comparison, column (2) reports estimates including all majority party MPs (i.e. newly elected and incumbents). It is identical to Table 6 except it drops observations in the 1690 parliament. The

[31] See Allison and Christakis (2006) for the benefits and costs of using conditional fixed effects logit models to study non-repeated events like the adoption of river acts.

[32] Linear fixed effects models that focus just on the subsample of candidate towns that had at least one river bill before 1741 produce similar results. See online Appendix Table B8 for more details.

[33] From 1690 to 1741 there were 6,669 MP-constituency-parliament observations in the data. Of these, 3,424 were incumbents and 3,310 were affiliated with the majority party in that parliament. Across these sets, 1,688 MPs were incumbents and were affiliated with the majority party.

Table 12

The Effects of Incumbent Majority Party MPs: Probit Models for Adoption of River Acts

Variables	(1) Coefficient (SE)	(2) Coefficient (SE)	(3) Coefficient (SE)	(4) Coefficient (SE)
Panel (a): Model estimates				
Majority party MPs county, incumbents only	0.127		−0.278**	−0.197
	(0.109)		(0.128)	(0.317)
Majority party MPs county, incumbents and newly elected		0.272***		
		(0.105)		
Majority Party MPs closest constituency, incumbents only	−0.0430		0.110	0.749**
	(0.102)		(0.131)	(0.356)
Majority party MPs closest constituency, incumbents and newly elected		−0.142		
		(0.0923)		
Majority party MPs upstream, incumbents only	0.0135		−0.0636	0.0106
	(0.0563)		(0.0715)	(0.102)
Majority party MPs upstream, incumbents and newly elected		0.0753*		
		(0.0441)		
Majority party MPs downstream, incumbents only	−0.161***		−0.231**	−0.964***
	(0.0617)		(0.0968)	(0.287)
Majority party MPs downstream, incumbents and newly elected		−0.187***		
		(0.0437)		
Sample restricted to towns with share of incumbent MPs within 25 miles ≥ 0.5?	No	No	Yes	No
Sample restricted to towns with share of incumbent MPs within 25 miles > 0.5?	No	No	No	Yes
Region by time trend?	Yes	Yes	No	No
Incumbents up, down, 25 miles?	Yes	Yes	No	No
Town and neighbouring town control variables?	Yes	Yes	Yes	Yes
Other acts, whig indicator, time trend?	Yes	Yes	Yes	Yes
Pseudo R^2	0.31	0.34	0.45	0.71
Observations	4,988	4,988	3,007	2,412
Panel (b): Adjusted probability of river act				
% change in probability of act going from low to high downstream majority party MPs	−73.0	−88.0	−81.0	−95.0

Notes. Robust standard errors clustering on towns reported. *** p < 0.01, ** p < 0.05, * p < 0.1.

coefficient estimates for downstream majority party MPs and their magnitude are very similar. For county and upstream majority party MPs, the coefficient is smaller when using incumbent majority party MPs only. Their positive relationship with river acts apparently comes from newly elected MPs.

One potential concern with the preceding analysis is that towns with incumbent MPs nearby are different from other towns, raising concerns about identification based on the variation in majority party MPs near these towns.[34] To investigate this issue, I use tests for 'balance' between control and treatment groups (see Hansen and Bowers, 2008). While there is no binary treatment for candidate towns with incumbent MPs in this setting, it is possible to identify those with a high share of incumbent MPs in

[34] Incumbent control was possibly related to aristocratic control over constituencies or to a strong connection between the voters and incumbents on religious or non-economic issues. See Speck (1970) and O'Gorman (1989) for a discussion of how MPs were selected to represent constituencies.

constituencies within 25 miles. The choice of MPs within 25 miles is consistent with the general focus on neighbouring towns and constituencies. A binary variable is created that is one if the town's share of all MPs within 25 miles who were incumbents is ≥0.5 and 0 otherwise. Note that the distribution for the share of incumbent MPs within 25 miles looks approximately normal within the interval between 0 and 1 but there is a 'mass' of towns that have a share exactly equal to 0.5. Therefore, I define a second binary variable equal to one if the share of incumbent MPs is strictly > 0.5.[35]

Having defined candidate towns treated with higher incumbent MPs within 25 miles, I turn to a comparison of their observable characteristics with respect to other candidate towns. I conduct difference in means tests for the variables in $town_i$, $neighbour_i$, $geography_{it}$ and $region_i$, along with the number of downstream and upstream MPs taken from $political_{it}$. These 30 variables include all the fixed characteristics of towns with the qualification that elevation and distance to navigation head change as downstream towns improved navigation. The results show that towns treated with a higher share of incumbent MPs are indeed different from all other towns with respect to many observable characteristics. The same conclusion holds irrespective of defining treatment based on the share of incumbent MPs being strictly > 0.5 or ≥ 0.5.[36] An omnibus test assessing balance on all of the linear combinations of all the 30 observable characteristics further confirms that towns treated with more incumbent MPs nearby are generally different from other towns in their fixed characteristics.[37]

While potentially problematic, imbalance does not necessarily affect the conclusions drawn from studying variation in adoption outcomes for towns that had incumbent majority party MPs *versus* towns that did not. To investigate, I run the same probit model for the adoption of river acts but restrict the sample to towns that were treated with a higher share of incumbent MPs within 25 miles. Here the adoption outcomes for candidate towns with more incumbents and more majority party MPs are being compared with towns that also had more incumbents but not more majority party MPs. It is reasonable to assume that unobservable characteristics are more similar across these two groups, possibly improving identification.

The last two specifications in Table 12 examine the results. Column (3) restricts the sample to candidate towns with a share of incumbent MPs ≥ 0.5 and column (4) restricts to towns with a share strictly > 0.5. In both, variables for the number of upstream and downstream incumbent MPs within 25 miles are dropped, and the same for the geography and region by year trend variables. Otherwise, the specification is the same as columns (1) and (2). The coefficient for more incumbent downstream majority party MPs is negative and significant in all the specifications, and implies a similar magnitude. The sign and significance levels vary across columns for the incumbent county majority party MP variable, indicating the effect depends on which

[35] See online Appendix B.8 for a histogram showing the distribution of the share of incumbent MPs within 25 miles. The share threshold of 0.5 splits the distribution nicely. Results using different share thresholds of 0.45 and 0.55 are also discussed in online Appendix B.8.

[36] Online Appendix Table B9 reports differences in means tests for the two definitions of the treatment group.

[37] The omnibus test is based on Hansen and Bowers (2008) and the Xbalance command in R. The details are shown in online Appendix Table B10. Across the two main treatment definitions for towns with a high share of incumbent MPs, the chi-square statistic implies the null hypothesis of balance is easily rejected.

towns are being compared. A similar finding applies to incumbent majority party MPs in the closest constituency.

The effects of incumbent downstream majority party MPs are further explored using entropy balancing methods (see Hainmueller, 2012; Hainmueller and Xu, 2013). It also addresses concerns that towns with more incumbent downstream majority party MPs have different characteristics from other towns. The main conclusions do not change and are discussed further in online Appendix B.9.

The extended analysis of this Section suggests that the estimated effect of county majority party MPs is less robust and possibly captures the unobserved capabilities of promoting towns. These appear to be important in determining towns' adoption of river acts and influencing towns' political connections, specifically in getting county majority party MPs to represent their interests. By contrast, there is no evidence in this Section that the estimated effects of downstream majority party MPs are masking other factors. Thus, the evidence generally confirms that downstream interests were successful in delaying/blocking the expansion of Britain's river transportation network.

9. Heterogeneous Effects in Party Connections

This Section examines heterogeneous effects in majority party connections. The estimates are detailed in the online Appendix B.10 and are briefly summarised here. The differences between the Whigs and Tories are analysed by including interactions between the Whig majority indicator and the variables for majority party MPs. The most striking differences are the larger negative effect of downstream majority party MPs under the Whigs, and the larger negative effect of MPs in the closest constituency under the Tories.[38] The latter may point to the Tories stronger connection with local landowners and other interests often opposed to river acts.

Each party had stronghold constituencies that would yield party wins in most elections. I use information identifying party strongholds and incorporate county, upstream and downstream stronghold variables in the river act adoption model.[39] One interesting result is that county strongholds have their own positive effect on river acts above the effect of majority party MPs in the county. This suggests that majority parties may have treated county strongholds differently. Other interesting results show that the stronghold effect is negative for upstream MPs, whereas it is positive for upstream majority party MPs. One interpretation is that majority parties favoured connected supporters of river acts more if they were swing constituencies.

Finally, in a related specification, I consider whether majority party effects differed according to the degree of electoral competition. Variables are created to measure the numbers of MPs that were from the majority party and who came from constituencies that had a contest in the election for the current parliament. There is a positive

[38] See online Appendix Table B13 for the estimates and illustrative figures.

[39] Stronghold MPs are counted in neighbouring constituencies depending on which party was in the majority of that parliament (Bogart, 2016). The baseline adoption model is estimated including upstream, downstream, and county strongholds along with the same for majority party MPs. The results are reported in online Appendix Table B14.

interaction effect between contests and majority party MPs upstream.[40] It suggests that majority parties favoured connected supporters of river acts more if their nearby MPs won the seat following a competitive election.

To summarise this section's findings, the effect of certain political party connections varied depending on whether the Whigs or Tories were in power. Also, they varied with the degree of electoral competition across constituencies.

10. Conclusion

This paper studies how influence and party connections affected the diffusion of river navigation acts across towns in England and Wales from 1690 to 1741. The results show that the economic and political characteristics of navigation supporters and opponents in neighbouring areas had a large effect. For example, more towns with roads in upstream areas (generally supporters) increased the likelihood of a town's river bill succeeding in parliament and more towns with harbours downstream (generally opponents) reduced the likelihood of the bill succeeding. Such factors were as important as project feasibility, measured by elevation changes, in determining whether a town was blocked from getting an act.

Another important factor was the strength of majority party representation in neighbouring political constituencies. Having more downstream connections to the majority party reduced the likelihood of a town's bill succeeding in parliament and it contributed to towns getting blocked from navigation acts. The identity of the majority party was also relevant. Whig majorities increased the probability of river acts being adopted, although the Whigs were not significantly more favourable to the passage of bills in parliament.

The findings speak to the nature of institutions after the Glorious Revolution of 1689. The institutional environment was not favourable to rapid adoption of infrastructure or to adoption based on economic demands alone. Interest groups were powerful and could block projects that went against their interest. The Tory party, which controlled the House of Commons for several parliaments in the 1690s, 1700s, and 1710s, contributed to the blocking power or bias from interest group pressures. The Whigs appear to be more pro-development than the Tories but they too could succumb to interest group pressures. Thus, the efficacy of British institutions in the early 1700s looks more mixed than some accounts would suggest (North and Weingast, 1989; Acemoglu *et al.*, 2005; Bogart, 2011). A conjecture is that the greater political influence of groups outside the traditional elite led to an intensification of lobbying which had both pro and anti-development effects.

More generally, the case of navigation improvements in Britain offers insights to the study of infrastructure, politics and development. First, it focuses attention on the distributional effects of infrastructure and efforts to block projects. Second, political connections clearly matter, and as this case shows, the distribution of connections can have important economic consequences. Finally, this article provides a good example of how interest groups can block or delay technologies when political institutions are weak or in transition.

[40] See online Appendix Table B14 for results.

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Submitted: 9 July 2014
Accepted: 10 June 2016

Additional Supporting Information may be found in the online version of this article:

Appendix A. Data and Sources.
Appendix B. Additional Tables.
Data S1.

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